Frascati, 10 September 2019

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EXCELENCIA SEVERO OCHOA

Global Climate and Air Quality Research for Services and Operations

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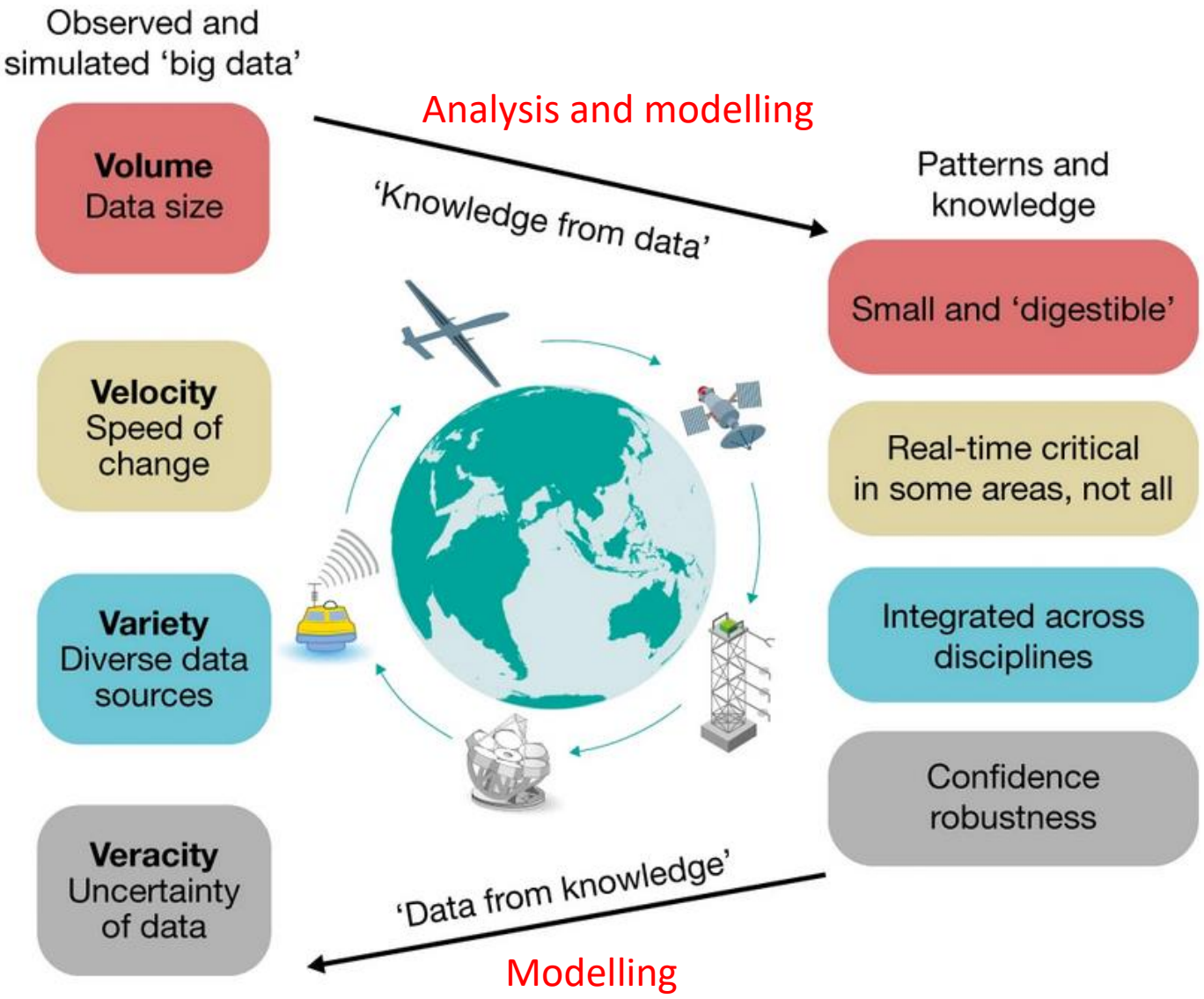
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

ICREA

Geophysical data and knowledge



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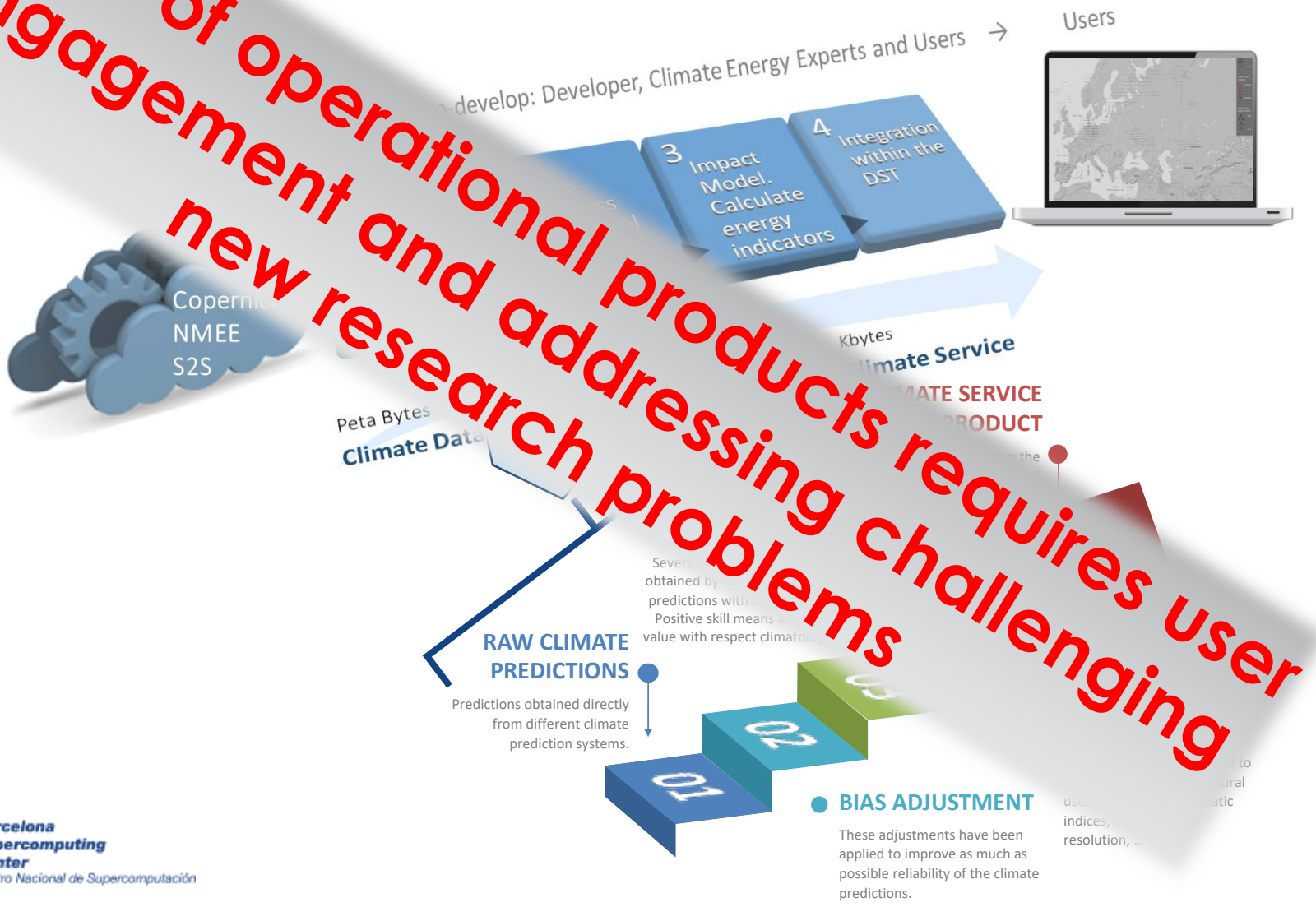
Reichstein et al. (2019, Nature)

The research-provider-service chain

Even w re is information in the environmental variables, converting the infor oven usefulness for a specific application involves a complex cha

Value of operational products requires user engagement and addressing challenging new research problems



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Air quality

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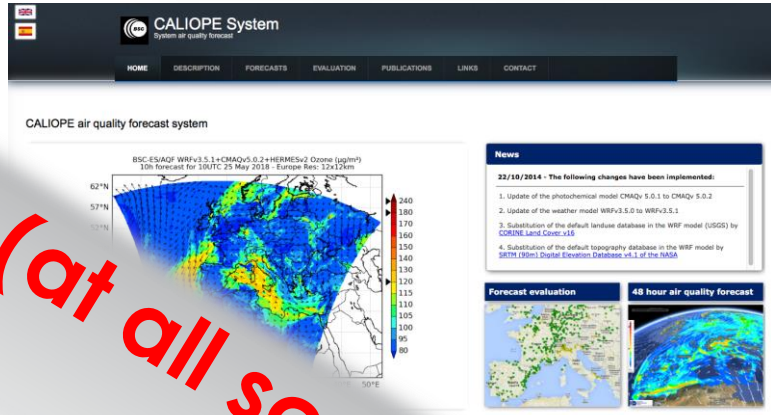
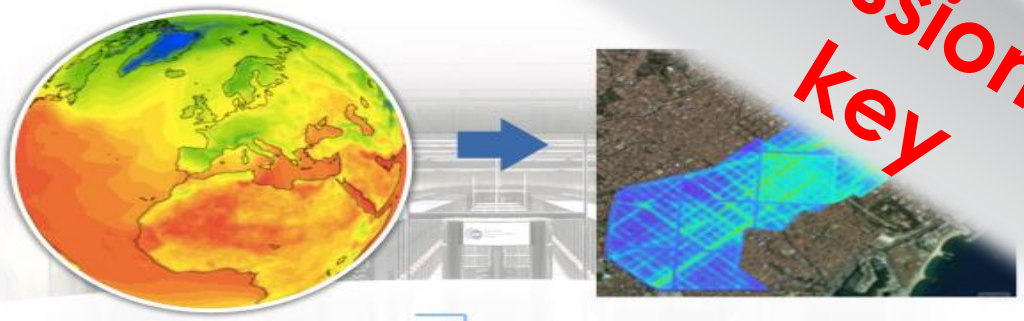
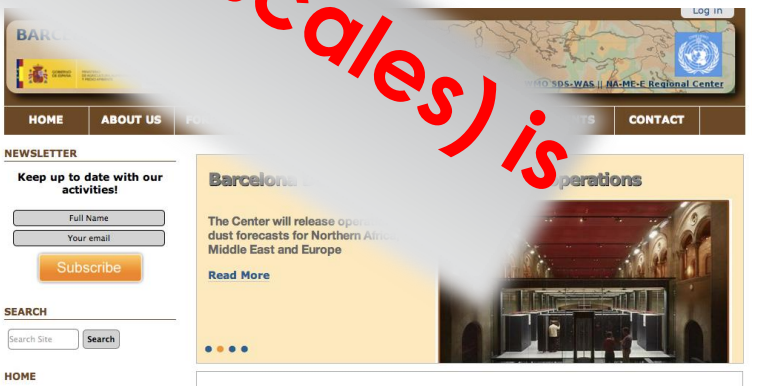
Air quality forecasts

- In-house Multiscale Online Nonhydrostatic Atmosph re CHemistry **model** (MONARCH): gas phase a sol schemes, atmospheric proce interactions.
- Global, r n **air quality forecasts**.
- Contribution t MO Dust centers and ICAP multi-m cast **ensemble**.

Modelling the emissions (at all scales) is key







Multi-scale models
- Global
- Regional
- Local

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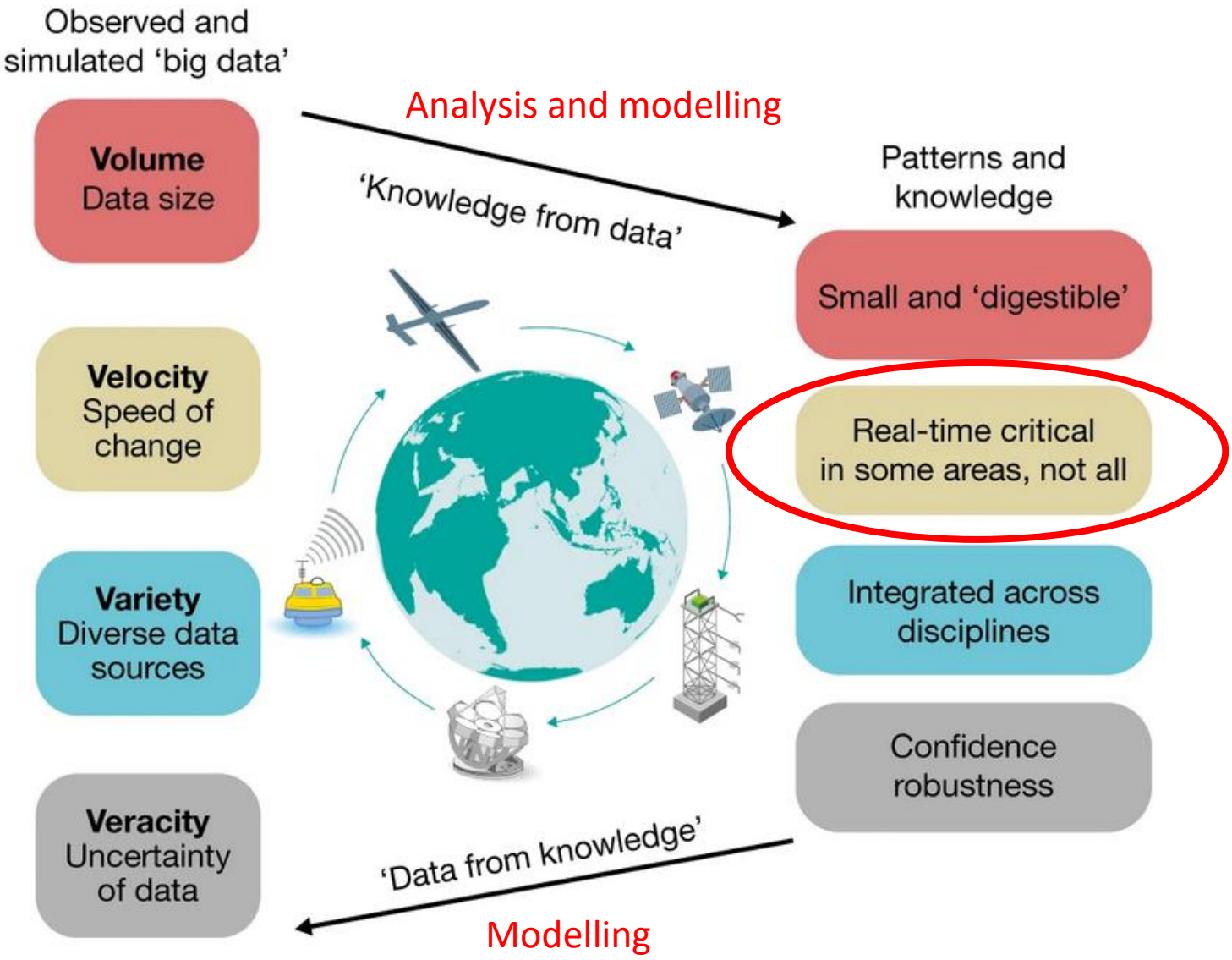
World Meteorological Organization

Geophysical data and knowledge



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Reichstein et al. (2019, Nature)

Pollution emission modelling

Maritime **emission prediction** from the Automatic Identification System and fog computing data using conditional restricted Boltzmann machines and CNN methods.

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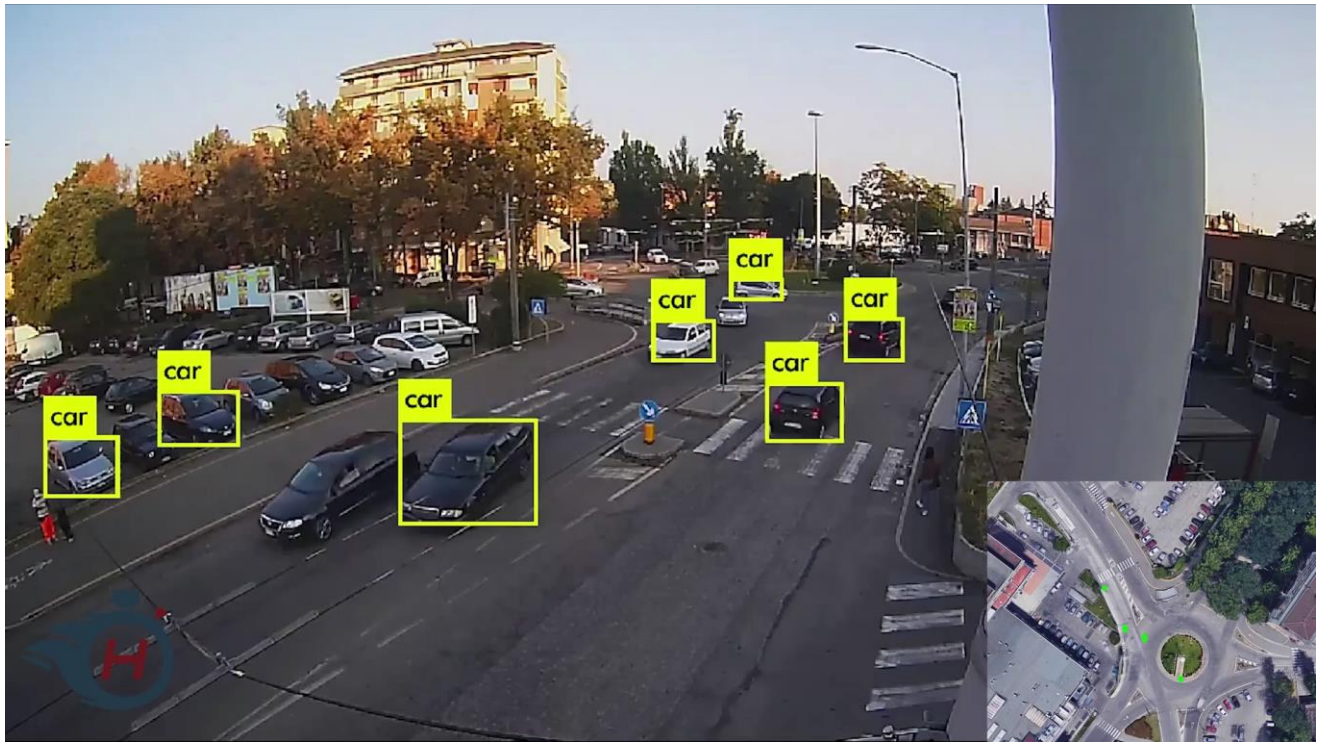
Collaboration with CS Department

Pollution emission modelling

Mining urban activity data with pattern recognition from network of city council cameras including edge computing for emission and air quality modelling and forecasting



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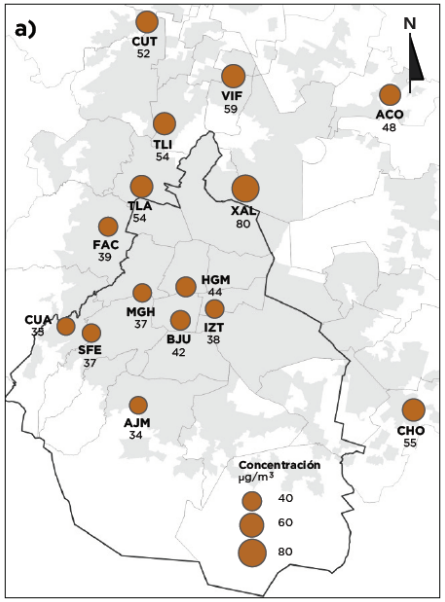
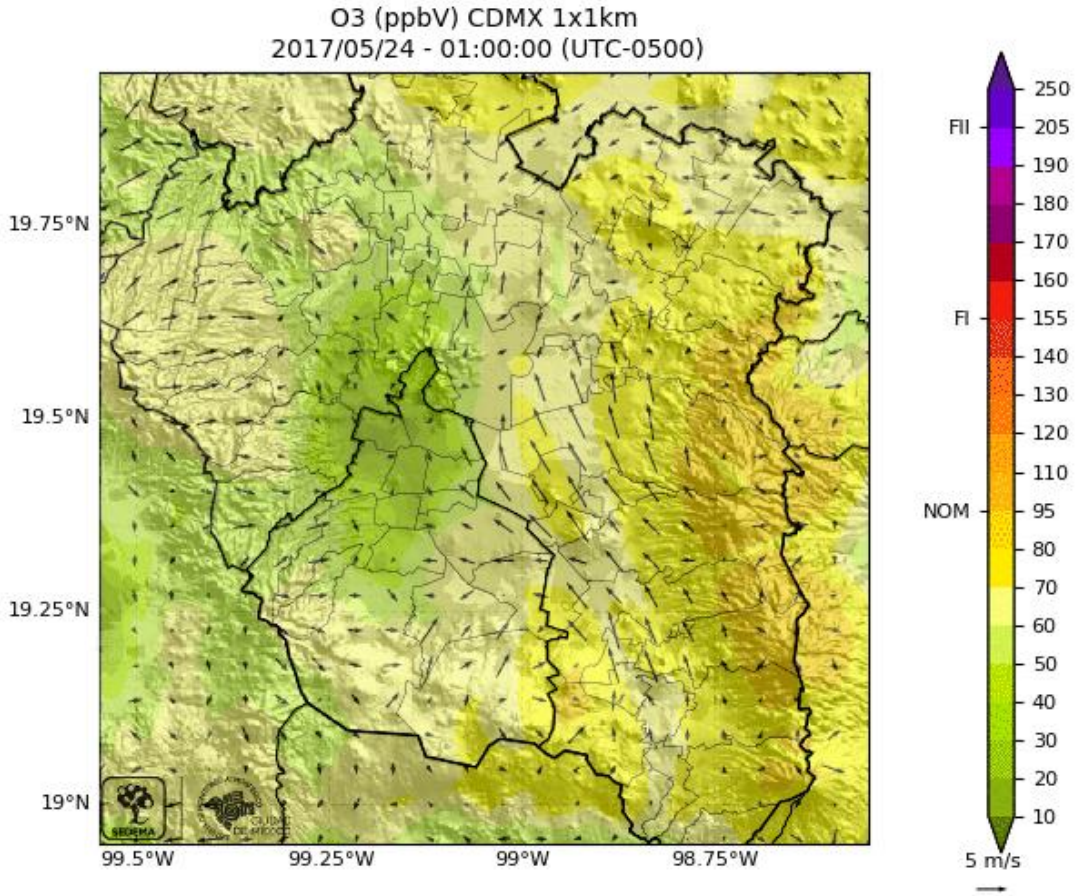
Collaboration with CS Department

Merging model and observed data

Mexico DF surface ozone forecasts: observations and model outputs for 2017





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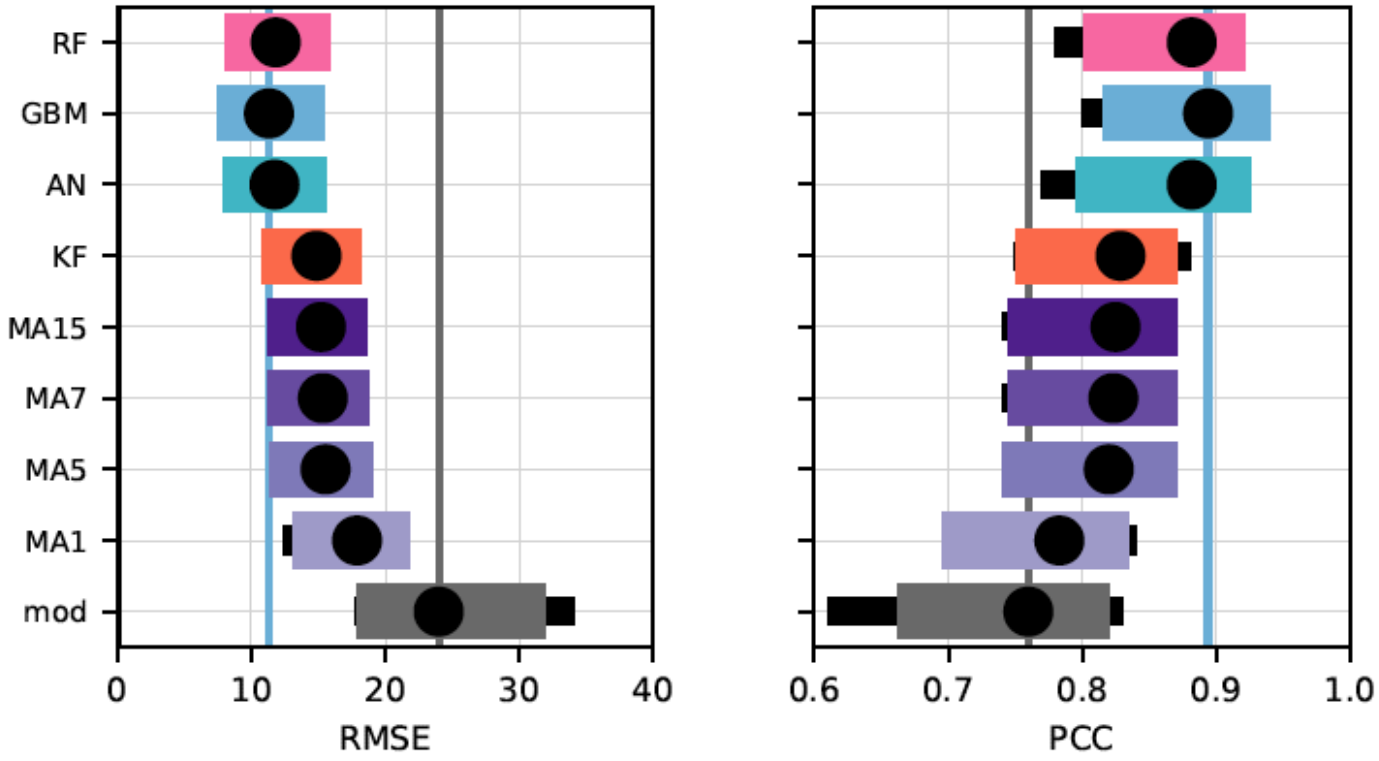
Merging model and observed data

Mexico DF surface ozone forecasts: observations and post-processed model outputs for 2017

Forecasts adjusted independently for individual stations of the network. Best performance obtained with analogue and gradient boosting machine methods.



Climate

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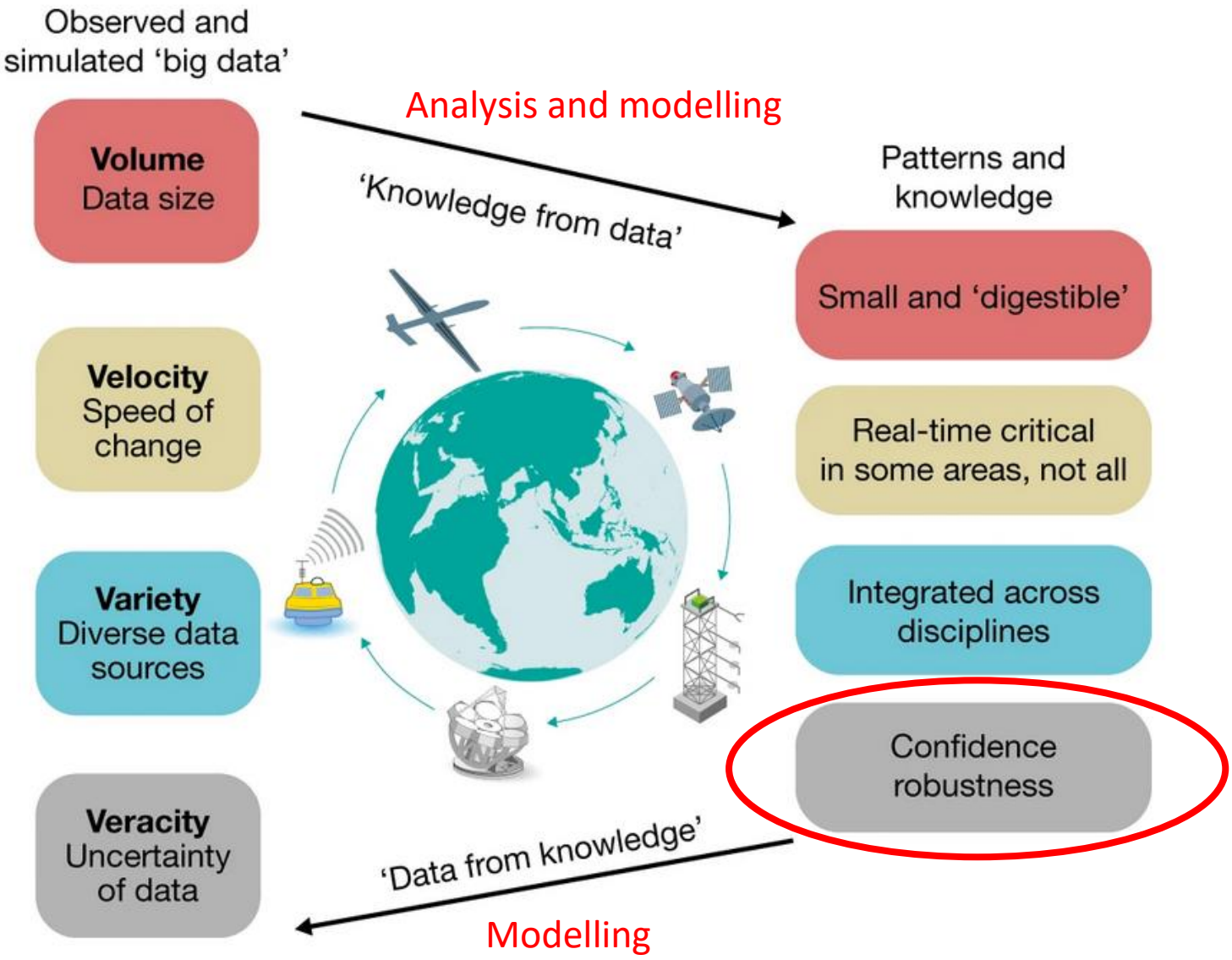
Geophysical data and knowledge



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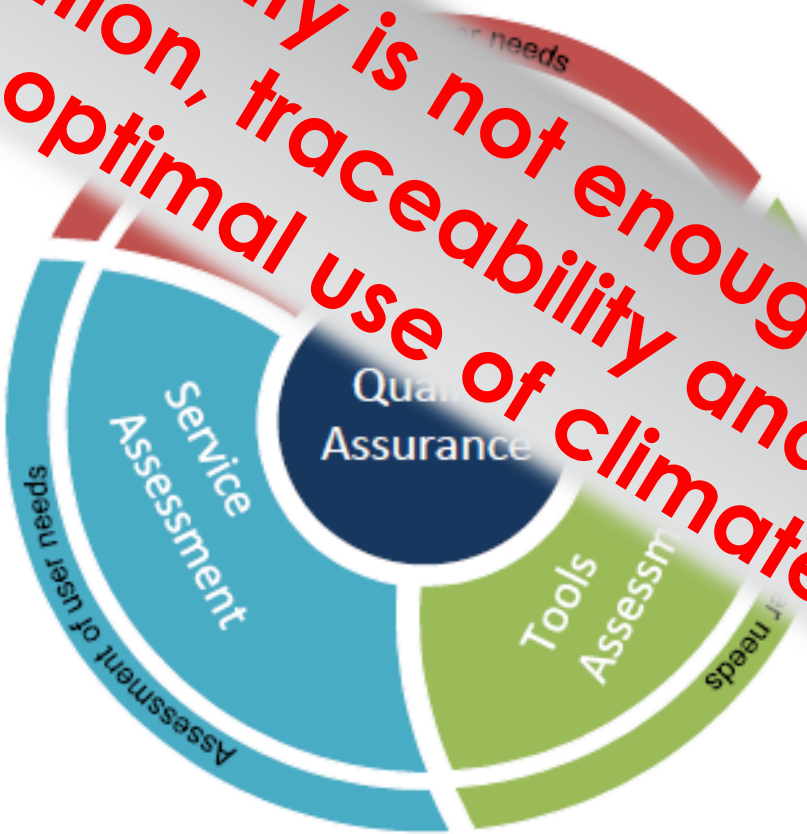
Reichstein et al. (2019, Nature)

Evaluation and quality control of climate data

The C… Climate Change Service (C3S) is developing the evaluation an… (EQC) function of its climate data store to:

- …erarching EQC service for the whole CDS
- P… …ality assessment

Interoperability is not enough: lacking documentation, traceability and standards prevent optimal use of climate data



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…nge Service
…limate.copernicus.eu
ECMWF
opernicus
Europe's eyes on Earth

Evaluation and quality control of climate data

The C3S climate data store distributes satellite-based climate variables as well as model-based data.

Based on information obtained by providers and reviewed by EQC

INTRODUCTION

- Dataset overview
- Temporal and spatial coverage and resolution
- Providers
- Dataset version
- Record update

USER DOCUMENTATION

- User guide
- Scientific methodology
- Uncertainty quantification
- Validation
- Inter-comparison

ACCESS

- Toolbox compatibility
- Archiving

Based on results of EQC assessment

INDEPENDENT ASSESSMENT

- Data check
- Expert evaluation
- Maturity matrix
- Summary of the independent assessment

- ❑ The synthesis table is a tool to organise and homogenize the EQC information
- ❑ Its layout is independent of the product type selected
- ❑ Each box gives the specific EQC information of interest

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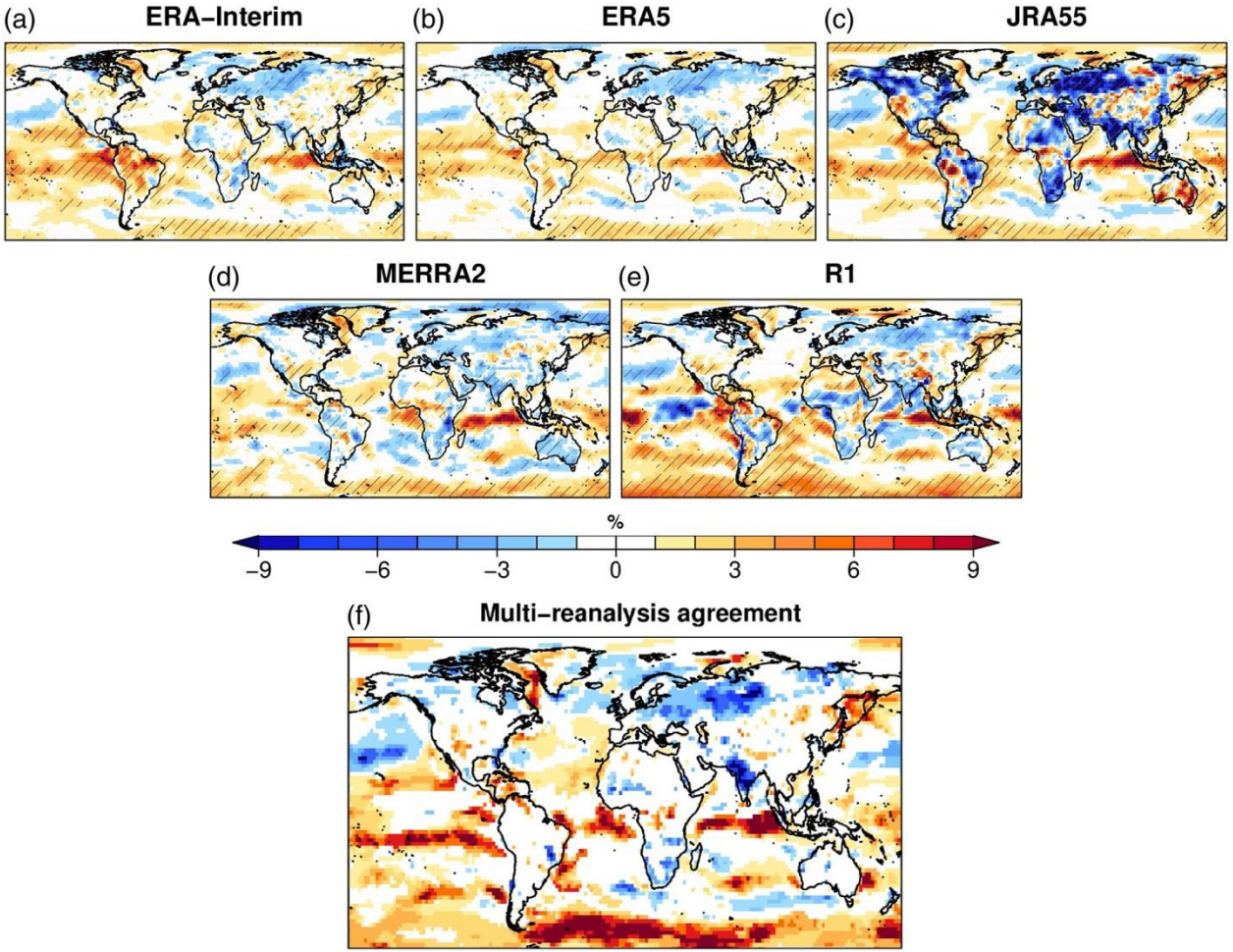
Climate Change Service
climate.copernicus.eu
IMPLEMENTED BY ECMWF
Copernicus Europe's eyes on Earth

Observational uncertainty relevant to users

10-m wind speed variability (in percentage of the mean wind) for the multi-reanalysis (MR) and five reanalyses in DJF over 1981-2017.



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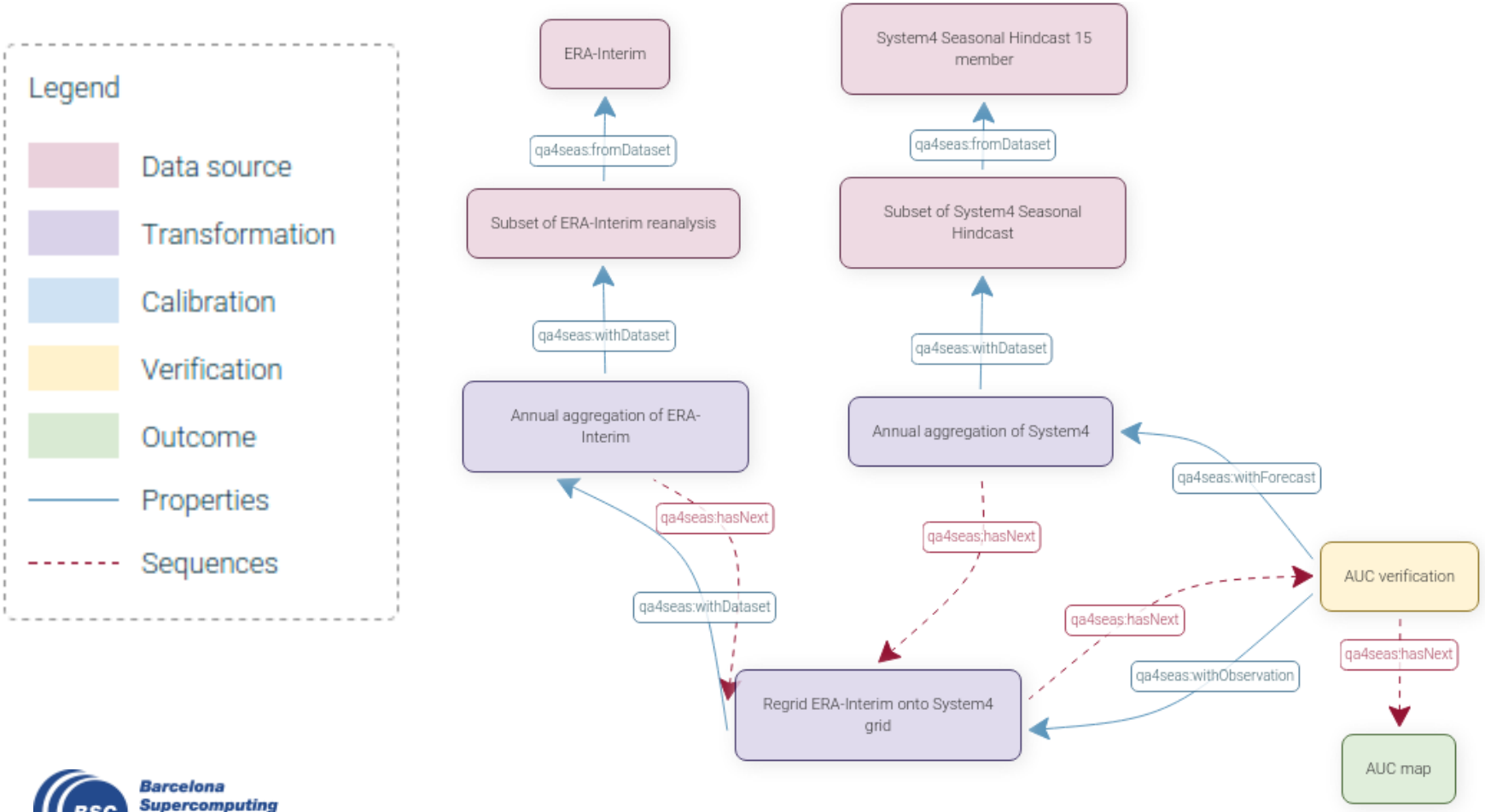
Ramon et al. (2019, QJRMS)

How traceable are climate products?

Generalised **metadata** provision and workflow **provenance** is a minimum requirement to ensure a minimum quality of the forecast-based climate information.



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J. Bedia (Predictia)

Summary

- Requests for contextual, environmental user-oriented information of predictive nature based on both EO and process-based model simulations comes from a broadening range of users.
- Such information needs to be addressed from an operational services perspective where AI plays an increasing role. Addressing this requirement require a new paradigm for environmental research.
- Applications struggle with the current compartmental provision of both data and information.
- Entry-level documentation and application of standards, when they exist, have become fundamental.